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SHAMPOO COMPOSITIONSTechnical Field

5 The invention is concerned with rinse-off hair-conditioning compositions which are applied to the hair and then substantially rinsed away. It is particularly concerned with hair shampoo compositions, which both clean the hair and provide conditioning benefit to the hair. More  
10 specifically, it is concerned with improving the deposition of silicone conditioning oil onto the tip region of hair relative to the root region, from shampoo compositions which contain dispersed hydrophobic conditioning oil droplets and which are substantially free of cationic deposition  
15 polymers.

Background and Prior Art

Compositions which provide a combination of cleansing and  
20 conditioning to the hair are well know in the art. Such shampoo or shower-gel compositions typically comprise one or more surfactants for shampooing or cleansing purposes and one or more conditioning agents. The purpose of the conditioning agent is to make the hair easier to comb when  
25 wet and more manageable when dry, e.g. less static and fly-away. Typically, these conditioning agents are water-insoluble oily materials, cationic polymers or cationic surfactants.

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Amongst the most popular conditioning agents used in shampoo products are oily materials such as mineral oils, naturally occurring oils such as triglycerides and silicone polymers. These are generally present in the shampoo as dispersed  
5 hydrophobic emulsion droplets. Conditioning is achieved by the oily material being deposited onto the hair resulting in the formation of a film.

Conditioning compositions which provide conditioning only,  
10 without cleansing surfactants, are also well known in the art. Such compositions are generally applied to the hair after the cleansing composition has been rinsed away.

One method to improve deposition of conditioning oils onto  
15 hair is to use large droplets of oil. This method relies on physical contact between the hair and the droplets followed by the oil droplet wetting the hair surface and spreading.

Natural oils secreted by the sebaceous gland at the base of  
20 the hair lead to hair being more hydrophobic near the root rather than near the tip. This means that droplets deposited onto hair by the use of large droplets of oil are more likely to spread and form films on the hair at the base of the hair rather than near the tip of the hair, and this  
25 is found in practice for prior art compositions.

Another method to enhance deposition of the conditioning oil droplets onto the hair is to employ a cationic deposition  
polymer in the composition. The use of such polymers is  
30 well known in the prior art.

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The use of cationic polymers means that the oil droplets are flocculated with the cationic polymer on dilution of the shampoo when the hair is rinsed. This leads to  
5 indiscriminate deposition of the cationic polymer, conditioning oil and any other insoluble materials onto the hair. The presence of extraneous materials in addition to the conditioning oil can lead to dulling of the appearance of the hair (loss of shine) and also to a heavy feel to the  
10 hair (because of the presence of the cationic polymer).

Certain consumers find the effects arising from the two deposition methods described above to be undesirable in that they lead to the hair feeling greasy at the roots or heavy  
15 and dull.

In attempts to overcome the problems in the prior art, it has been considered desirable to target the deposition of the conditioning oil droplets onto the tip regions of the  
20 hair in preference to the root regions, and much research has been carried out in this field of work. Although it would be desirable to make the surface of the oil droplets more hydrophilic, it had always been considered that the high levels of surfactant in shampoo compositions would  
25 dominate the surface chemistry and hydrophilicity of the oil droplets. Thus the conventional view is that irrespective of any additives added to the conditioning oil droplets, the shampoo surfactant would control the droplet hydrophilicity and deposition.

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It has now surprisingly been found, that by blending certain types of surface active block copolymer with silicone conditioning oil emulsion droplets, enhanced deposition of the droplets onto the tip regions of hairs can be achieved.

5 Although not wishing to be bound by the scientific reasoning underlying this phenomenon, it seems that surface active polymer remains at the droplet surface, even in the presence of other surfactant molecules from the shampoo, making the droplets more hydrophilic than the droplets in conventional  
10 oil droplet-containing shampoos. This leads to improved deposition of the droplets towards the more hydrophilic tip region of the hair.

#### Summary of the invention

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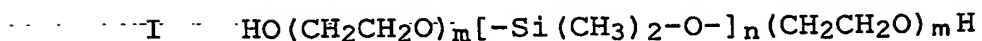
In a first aspect the invention provides an aqueous hair conditioning composition comprising:

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- a) from 1% to 50% by weight of a cleansing surfactant,
- b) discrete, dispersed droplets comprising a water insoluble silicone conditioning oil, wherein the Sauter mean diameter of the droplets ( $D_{3,2}$ ) is from 2 to 100 micrometres and

25

- c) a surface active block copolymer according to formula I:



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wherein m is 30 or more, n is 5 or more and the ratio n/m is from 0.1 to 1.2.

### Detailed Description

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In the following description, EO represents CH<sub>2</sub>CH<sub>2</sub>O and PO represents

CH<sub>2</sub>CH<sub>2</sub>O

|

10 CH<sub>3</sub>

Compositions in accordance with the invention are formulated as compositions for the cleansing of hair and subsequent rinsing such as shampoos, cleansing mousses or shower gels.

15 It is highly preferred that cleansing compositions according to the invention should contain less than 0.01% by weight of any cationic deposition polymer.

### Surface Active Polymer

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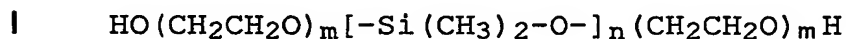
A suitable surface active block copolymer for use in compositions according to the invention is a silicone-based block copolymer according to formula I above. Suitable silicone block copolymers for use in compositions according to the invention comprise from 50% to 85% by weight of polyethyleneoxide in the molecular formula, preferably 60% to 85%. Suitable silicone block copolymers have a molecular weight of 3000 unified mass units or more, preferably 3500 or more, more preferably 4000 or more.

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In formula I, the degree of polymerisation, m, is indicated as the same for each polyethyleneoxide block. For the sake of clarity, it should be explained that these degrees of polymerisation are mean values and are approximately the same rather than necessarily identical. This is a result of the polymerisation methods used for production of the compounds.

Suitably surface active block copolymers for the invention are according to formula I



wherein m is 30 or more, preferably 35 or more, n is 5 or more, preferably 7 or more, more preferably 10 or more and wherein the ratio n/m is from 0.1 to 1.2, preferably from 0.2 to 0.7.

Suitably, the level of surface active block copolymer is in the range from 0.01% to 0.4% by weight of the composition, preferably from 0.02% to 0.3%, more preferably from 0.04% to 0.2%, even more preferably from 0.05% to 0.1%.

A suitable method for the preparation of these polymers is described in detail in a paper by J. Yang, G. Wegner and R. Konigsfeld in "Colloid and Polymer Science" volume 270 pages 1080 to 1084 (1992).

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Silicone Conditioning Oil

An essential component of compositions according to the invention is hydrophobic silicone conditioning oil. In order for such an oil to exist in discrete droplets in the compositions according to the invention, it must be water-insoluble. By water-insoluble is meant that the solubility in water at 25°C is 0.01% by weight of water or less.

It is essential that the  $D_{3,2}$  (Sauter) average particle diameter of the hydrophobic conditioning oil droplets in the composition is 2 micrometres or more, preferably 5 micrometres or more, and more preferably 12 micrometres or more. The average particle size of the oil droplets in the composition is 100 micrometres or less to prevent problems in stabilising the composition from separation of components.

Silicone  $D_{3,2}$  Sauter mean droplet diameter may be measured by means of a laser light scattering technique, for example using a 2600D Particle Sizer from Malvern Instruments.

The total amount of silicone conditioning oil present in the composition is preferably from 0.01% to 10 % by weight of the total composition more preferably from 0.3% to 5%, most preferably 0.5% to 3 %.

Suitable silicones for use as conditioning oils include polydiorganosiloxanes, in particular polydimethylsiloxanes which have the CTFA designation dimethicone. Also suitable

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for use compositions of the invention are polydimethyl siloxanes having hydroxyl end groups, which have the CTFA designation dimethiconol.

- 5 It is preferred if the silicone oil also comprises a functionalised silicone other than the surface active block copolymer of the invention.

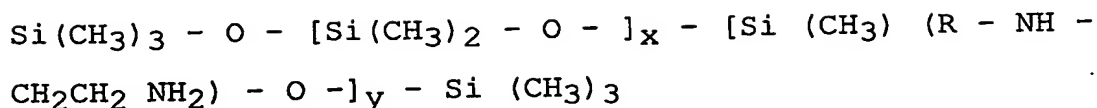
Suitable functionalised silicones include, for example,  
10 amino-, carboxy-, betaine-, quaternary ammonium-, carbohydrate-, hydroxy- and alkoxy-substituted silicones. Preferably, the functionalised silicone contains multiple substitutions.

- 15 For the avoidance of doubt, as regards hydroxyl-substituted silicones, a polydimethylsiloxane merely having hydroxyl end groups (which have the CTFA designation dimethiconol) is not considered a functionalised silicone within the present invention. However, a polydimethylsiloxane having hydroxyl  
20 substitutions along the polymer chain is considered a functionalised silicone.

Preferred functionalised silicones are amino-functionalised silicones. Suitable amino functionalised silicones are  
25 described in EP 455,185 (Helene Curtis) and include trimethylsilylamodimethicone as depicted below, and are sufficiently water insoluble so as to be useful in compositions of the invention:



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wherein  $x + y$  is a number from about 50 to about 500, and  
5 the weight percent amine functionality is in the range of  
from about 0.03% to about 8%, and wherein R is an alkylene  
group having from 2 to 5 carbon atoms. Preferably, the  
number  $x + y$  is in the range of from about 100 to about 300,  
and the weight percent amine functionality is in the range  
10 of from about 0.03% to 8%.

As expressed here, the weight percent amine functionality is  
measured by titrating a sample of the amino-functionalised  
silicone against alcoholic hydrochloric acid to the  
15 bromocresol green end point. The weight percent amine is  
calculated using a molecular weight of 45 (corresponding to  
 $\text{CH}_3 - \text{CH}_2 - \text{NH}_2$ ).

Suitably, the weight percent amine functionality measured  
20 and calculated in this way is in the range from 0.03% to 8%,  
preferably from 0.5% to 4%.

An example of a commercially available amino-functionalised  
silicone useful in the silicone component of the composition  
25 of the invention is DC-8566 available from Dow Corning.

By "amino functional silicone" is meant a silicone  
containing at least one primary, secondary or tertiary amine  
group, or a quaternary ammonium group. Examples of suitable  
30 amino functional silicones include: polysiloxanes having the

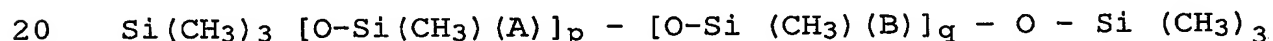
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CTFA designation "amodimethicone". Specific examples of amino functional silicones suitable for use in the invention are the aminosilicone oils DC-8220, DC-8166, DC-8466, and DC-8950-114 (all ex Dow Corning), and GE 1149-75, (ex  
 5 General Electric Silicones). Suitable quaternary silicone polymers are described in EP-A-0 530 974. A preferred quaternary silicone polymer is K3474, ex Goldschmidt.

Another preferred functional silicone for use as a component  
 10 in the hydrophobic conditioning oil is an alkoxy-substituted silicone. Such molecules are known as silicone copolyols and have one or more polyethyleneoxide or polypropyleneoxide groups bonded to the silicone polymer backbone, optionally through an alkyl linking group.

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A non-limiting example of a type of silicone copolyol useful in compositions of the invention has a molecular structure according to the formula depicted below:



In this formula, A is an alkylene chain with from 1 to 22 carbon atoms, preferably 4 to 18, more preferably 10 to 16.

B is a group with the structure:  $-(\text{R})-(\text{EO})_r(\text{PO})_s-\text{OH}$  wherein

25 R is a linking group, preferably an alkylene group with 1 to 3 carbon atoms. Preferably R is  $-(\text{CH}_2)_2-$ . The mean values of r and s are 5 or more, preferably 10 or more, more preferably 15 or more. It is preferred if the mean values of r and s are 100 or less. In the formula, the value of p

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is suitably 10 or more, preferably 20 or more, more preferably 50 or more and most preferably 100 or more. The value of  $q$  is suitably from 1 to 20 wherein the ratio  $p/q$  is preferably 10 or more, more preferably 20 or more. The  
5 value of  $p + q$  is a number from 11 to 500, preferably from 50 to 300.

Suitable silicone copolyols for use in compositions according to the invention have an HLB of 10 or less,  
10 preferably 7 or less, more preferably 4 or less. A suitable silicone copolyol material is DC5200, known as lauryl dimethicone copolyol, available from Dow Corning. Hydrophile/Lipophile balance or HLB is a well known parameter used by those skilled in the art to characterise  
15 surface active molecules and emulsifiers. Suitable methods for the experimental determination of HLB are in Griffin W.C, Journal of the Society of Cosmetic Chemists, volume 1 page 311 (1949).

20 It is preferred to use a combination of functional and non-functional silicones as the conditioning oil. Preferably these are blended into common droplets prior to incorporation into compositions according to the invention.

25 The viscosity of the silicone oil blend measured in isolation from the rest of the composition (i.e. not the viscosity of any pre-formed emulsion, but of the silicone blend forming the hydrophobic conditioning oil) is preferably in the range from  $5,000 \text{ mm}^2 \text{ sec}^{-1}$  to  $1,000,000$   
30  $\text{mm}^2 \text{ sec}^{-1}$  at 25 °C. Suitable methods for measuring the

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viscosity of silicone oils are known to those skilled in the art, e.g. capillary viscometers. For high viscosity materials, a suitable method would be the use of a constant stress rheometer. Measurement of viscosity should be  
5 carried out at low shear rates where by the viscosity is independent of shear rate. A suitable shear rate is  $1 \text{ sec}^{-1}$ .

#### Cationic Deposition Polymer

10 A cationic deposition polymer is often used in hair treatment compositions, for enhancing conditioning performance. However this leads to problems arising from the cationic polymer also remaining adhered to the hair, which can, in some cases, lead to a dirty, sticky feel to  
15 the hair some hours after use of the cleansing and conditioning composition for some consumers.

Such cationic polymers may be a homopolymer or be formed from two or more types of monomers. The molecular weight of the polymer will generally be between 5 000 and 10 000 000 unified mass units, typically at least 10 000 and preferably in the range 100 000 to about 2 000 000. The polymers will have cationic, nitrogen-containing groups such as quaternary ammonium or protonated amino groups, or a mixture thereof.

It is highly preferred that compositions according to the invention should contain less than 0.04% by weight of such a cationic deposition polymer, more preferably less than 0.02%, even more preferably less than 0.01%. It is most preferred that such polymers are absent from the composition.

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Preparation of Compositions

One method for preparing compositions according to the invention is to add a silicone conditioning oil, along with  
5 the other components comprising the hair treatment composition, followed by suitable mixing of the composition in order to ensure that the blend is dispersed as droplets of a suitable size.

10 However it is preferred if the hydrophobic silicone conditioning oil is first formed into an aqueous emulsion prior to incorporation into the hair treatment composition. Thus another aspect of the invention is a method for preparing an aqueous hair conditioning composition  
15 comprising the steps of :

i) preparing a solution comprising water and the surface active block copolymer,

20 ii) adding a silicone conditioning oil to said solution,

iii) forming the solution and the silicone conditioning oil into an oil-in-water emulsion by high-shear  
25 mixing,

iv) dispersing said oil-in-water emulsion comprising the block copolymer into a hair conditioning composition.

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Another preferred method for preparing a hair conditioning composition according to the invention comprises the steps of:

- 5       i)    preparing an oil-in-water emulsion of a silicone conditioning oil,
- ii) dispersing the surface active block copolymer into the emulsion,
- 10       iii) dispersing said oil-in-water emulsion comprising the block copolymer into a hair conditioning composition.

15   Suitable emulsifiers for use in the preparation of the aqueous emulsion are well known in the art and include anionic, cationic, zwitterionic, amphoteric and nonionic surfactants, and mixtures thereof. Examples of anionic surfactants used as emulsifiers for the silicone particles  
20   are alkylarylsulphonates, e.g., sodium dodecylbenzene sulphonate, alkyl sulphates e.g., sodium lauryl sulphate, alkyl ether sulphates, e.g., sodium lauryl ether sulphate nEO, where n is from 1 to 20, alkylphenol ether sulphates, e.g., octylphenol ether sulphate nEO where n is from 1 to  
25   20, and sulphosuccinates, e.g., sodium dioctylsulphosuccinate.

Examples of nonionic surfactants suitable for use as emulsifiers for the silicone droplets are alkylphenol  
30   ethoxylates, e.g., nonylphenol ethoxylate nEO, where n is

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from 1 to 50 and alcohol ethoxylates, e.g., lauryl alcohol nEO, where n is from 1 to 50, ester ethoxylates, e.g., polyoxyethylene monostearate where the number of oxyethylene units is from 1 to 30.

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A preferred process for preparing oil-in-water emulsions of the mixed silicone droplets which can then be incorporated in the hair treatment compositions involves use of a mixer. Depending upon the viscosities of components of the silicone  
10 mixture a suitable mixer should be chosen so as to provide sufficient shear to give the required final particle size of the emulsion. Examples of suitable benchtop mixers spanning the range of necessary shear are Heidolph RZR2100, Silverson L4R, Ystral X10/20-750 and Rannie Mini-Lab 7.30VH high  
15 pressure homogeniser. Other mixers of similar specification are well known to those skilled in the art and can also be used in this application. Equally it is possible to manufacture oil-in-water emulsions of this description on larger scale mixers which offer similar shear regimes to  
20 those described above.

It is preferred if the aqueous phase of the emulsion contains a polymeric thickening agent to prevent phase separation of the emulsion after preparation. Preferred  
25 thickening agents are cross-linked polyacrylates, cellulosic polymers or derivatives of cellulosic polymers.

Preferably, the mixer is also capable of having the temperature of mixing controlled, e.g. it comprises a jacket  
30 through which a heat transfer fluid can be circulated.

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Cleansing Surfactant

Compositions according to the invention will comprise one or  
5 more cleansing surfactants which are cosmetically acceptable  
and suitable for topical application to the hair. Further  
surfactants may be present as an additional ingredient if  
sufficient for cleansing purposes is not provided by the  
emulsifier for the water-insoluble oily component. It is  
10 preferred that shampoo compositions of the invention  
comprise at least one further surfactant (in addition to any  
used as emulsifying agent for the silicone component) to  
provide a cleansing benefit.

15 Suitable cleansing surfactants, which may be used singularly  
or in combination, are selected from anionic, amphoteric and  
zwitterionic surfactants, and mixtures thereof. The  
cleansing surfactant may be the same surfactant as the  
emulsifier, or may be different.

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The total amount of cleansing surfactant (including any co-  
surfactant, and/or any emulsifier) in compositions of the  
invention is generally from 1 to 50, preferably from 2 to  
40, more preferably from 10 to 25 percent by weight of the  
25 composition. For the sake of clarity, the surface active  
block copolymer is not here considered to be a cleansing  
surfactant.



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### Anionic Cleansing Surfactant

Shampoo compositions according to the invention will typically comprise one or more anionic cleansing surfactants which are cosmetically acceptable and suitable for topical application to the hair.

Examples of suitable anionic cleansing surfactants are the alkyl sulphates, alkyl ether sulphates, alkaryl sulphonates, alkanoyl isethionates, alkyl succinates, alkyl sulphasuccinates, N-alkyl sarcosinates, alkyl phosphates, alkyl ether phosphates, alkyl ether carboxylates, and alpha-olefin sulphonates, especially their sodium, magnesium, ammonium and mono-, di- and triethanolamine salts. The alkyl and acyl groups generally contain from 8 to 18 carbon atoms and may be unsaturated. The alkyl ether sulphates, alkyl ether phosphates and alkyl ether carboxylates may contain from 1 to 10 ethylene oxide or propylene oxide units per molecule.

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Typical anionic cleansing surfactants for use in shampoo compositions of the invention include sodium oleyl succinate, ammonium lauryl sulphasuccinate, ammonium lauryl sulphate, sodium dodecylbenzene sulphonate, triethanolamine dodecylbenzene sulphonate, sodium cocoyl isethionate, sodium lauryl isethionate and sodium N-lauryl sarcosinate. The most preferred anionic surfactants are sodium lauryl sulphate, sodium lauryl ether sulphate(n)EO, (where n ranges from 1 to 3), ammonium lauryl sulphate and ammonium lauryl ether sulphate(n)EO, (where n ranges from 1 to 3).

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Mixtures of any of the foregoing anionic cleansing surfactants may also be suitable.

- 5 The total amount of anionic cleansing surfactant in shampoo compositions of the invention is generally from generally from 0.5 to 45, preferably from 1.5 to 35, more preferably from 5 to 20 percent by weight of the composition.

10 Co-surfactant

The composition can include co-surfactants, to help impart aesthetic, physical or cleansing properties to the composition.

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A preferred example is an amphoteric or zwitterionic surfactant, which can be included in an amount ranging from 0 to about 8, preferably from 1 to 4 percent by weight.

- 20 Examples of amphoteric and zwitterionic surfactants include alkyl amine oxides, alkyl betaines, alkyl amidopropyl betaines, alkyl sulphobetaines (sultaines), alkyl glycinate, alkyl carboxyglycinates, alkyl amphopropionates, alkylamphoglycinates, alkyl amidopropyl hydroxysultaines, 25 acyl taurates and acyl glutamates, wherein the alkyl and acyl groups have from 8 to 19 carbon atoms. Typical amphoteric and zwitterionic surfactants for use in shampoos of the invention include lauryl amine oxide, cocodimethyl sulphopropyl betaine and preferably lauryl betaine, 30 cocamidopropyl betaine and sodium cocamphopropionate.

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Another preferred example is a nonionic surfactant, which can be included in an amount ranging from 0 to 8, preferably from 2 to 5 percent by weight of the composition.

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For example, representative nonionic surfactants that can be included in shampoo compositions of the invention include condensation products of aliphatic (C<sub>8</sub> - C<sub>18</sub>) primary or secondary linear or branched chain alcohols or phenols with  
10 alkylene oxides, usually ethylene oxide and generally having from 6 to 30 ethylene oxide groups.

Other representative nonionic surfactants include mono- or di-alkyl alkanolamides. Examples include coco mono- or di-  
15 ethanolamide and coco mono-isopropanolamide.

Further nonionic surfactants which can be included in shampoo compositions of the invention are the alkyl polyglycosides (APGs). Typically, the APG is one which comprises an alkyl  
20 group connected (optionally via a bridging group) to a block of one or more glycosyl groups.

Preferred APGs are defined by the following formula:



25

wherein R is a branched or straight chain alkyl group which may be saturated or unsaturated and G is a saccharide group.

- 20 -

R may represent a mean alkyl chain length of from about C<sub>5</sub> to about C<sub>20</sub>. Preferably R represents a mean alkyl chain length of from about C<sub>8</sub> to about C<sub>12</sub>. Most preferably the value of R lies between about 9.5 and about 10.5. G may be selected  
5 from C<sub>5</sub> or C<sub>6</sub> monosaccharide residues, and is preferably a glucoside. G may be selected from the group comprising glucose, xylose, lactose, fructose, mannose and derivatives thereof. Preferably G is glucose.

10 The degree of polymerisation, n, may have a value of from about 1 to about 10 or more. Preferably, the value of n lies in the range of from about 1.1 to about 2. Most preferably the value of n lies in the range of from about 1.3 to about 1.5.

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Suitable alkyl polyglycosides for use in the invention are commercially available and include for example those materials identified as: Oramix NS10 ex Seppic; Plantaren 1200 and Plantaren 2000 ex Henkel.

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Other sugar-derived nonionic surfactants which can be included in compositions of the invention include the C<sub>10</sub>-C<sub>18</sub> N-alkyl (C<sub>1</sub>-C<sub>6</sub>) polyhydroxy fatty acid amides, such as the C<sub>12</sub>-C<sub>18</sub> N-methyl glucamides, as described for example in  
25 WO 92 06154 and US 5 194 639, and the N-alkoxy polyhydroxy fatty acid amides, such as C<sub>10</sub>-C<sub>18</sub> N-(3-methoxypropyl) glucamide.

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The composition according to the invention can also optionally include one or more cationic co-surfactants included in an amount ranging from 0.01 to 10, more preferably from 0.05 to 5, most preferably from 0.05 to 2 percent by weight of the composition.

A preferred blend of surfactants comprises a mixture of ammonium lauryl ether sulfate, ammonium lauryl sulfates, PEG 5 cocamide and cocomide MEA (CTFA designations).

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#### Suspending Agents

Optionally, the compositions according to the invention further comprise from 0.1 to 10 percent, preferably from 0.6 to 6 percent by weight of the composition, of a suspending agent. Suitable suspending agents are selected from polyacrylic acids, cross-linked polymers of acrylic acid, copolymers of acrylic acid with a hydrophobic monomer, copolymers of carboxylic acid-containing monomers and acrylic esters, cross-linked copolymers of acrylic acid and acrylate esters, heteropolysaccharide gums and crystalline long chain acyl derivatives. The long chain acyl derivative is desirably selected from ethylene glycol stearate, alkanolamides of fatty acids having from 16 to 22 carbon atoms and mixtures thereof. Ethylene glycol distearate and polyethylene glycol 3 distearate are preferred long chain acyl derivatives. Polyacrylic acid is available commercially as Carbopol 420, Carbopol 488 or Carbopol 493. Polymers of acrylic acid cross-linked with a polyfunctional agent, known as cross-linked polyacrylates, may also be

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used, they are available commercially as Carbopol 910, Carbopol 934, Carbopol 940, Carbopol 941 and Carbopol 980. An example of a suitable copolymer of a carboxylic acid containing a monomer and acrylic acid esters is Carbopol  
5 1342. All Carbopol (trade mark) materials are available from Goodrich. The CTFA name for these materials is Carbomer.

Suitable cross-linked polymers of acrylic acid and acrylate  
10 esters are Pemulen TR1 or Pemulen TR2. A suitable heteropolysaccharide gum is xanthan gum, for example that available as Kelzan mu.

#### Adjuvants

15 The compositions of the present invention may also contain adjuvants suitable for hair care. Generally such ingredients are included individually at a level of up to 2, preferably up to 1 % by weight of the total composition.

20 Among suitable hair care adjuvants, are natural hair root nutrients, such as amino acids and sugars. Examples of suitable amino acids include arginine, cysteine, glutamine, glutamic acid, isoleucine, leucine, methionine, serine and valine, and/or precursors and derivatives thereof. The  
25 amino acids may be added singly, in mixtures, or in the form of peptides, e.g. di- and tripeptides. The amino acids may also be added in the form of a protein hydrolysate, such as a keratin or collagen hydrolysate. Suitable sugars are glucose, dextrose and fructose. These may be added singly  
30 or in the form of, e.g. fruit extracts. A particularly

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preferred combination of natural hair root nutrients for inclusion in compositions of the invention is isoleucine and glucose. A particularly preferred amino acid nutrient is arginine. Another suitable adjuvant is glycolic acid.

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#### Optional Ingredients

Compositions of this invention may contain any other ingredient normally used in hair treatment formulations. These other ingredients may include viscosity modifiers, preservatives, colouring agents, polyols such as glycerine and polypropylene glycol, chelating agents such as EDTA, antioxidants, fragrances, antimicrobials and sunscreens. Each of these ingredients will be present in an amount effective to accomplish its purpose. Generally these optional ingredients are included individually at a level of up to 5% by weight of the total composition.

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#### Mousses

Hair treatment cleansing and conditioning compositions in accordance with the invention may also take the form of aerosol foams (mousses) in which case a propellant is included in the composition. This agent is responsible for expelling the other materials from the container and forming the hair mousse character.

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The propellant gas can be any liquefiable gas conventionally used for aerosol containers. Examples of suitable propellants include dimethyl ether, propane, n-butane and isobutane, used singly or in admixture.

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The amount of the propellant gases is governed by normal factors well known in the aerosol art. For hair mousses, the level of propellant is generally from 3 to 30, preferably from 5 to 15 % by weight of the total composition.

#### Mode of Use

The compositions of the invention are primarily intended for topical application to the hair and/or scalp and or skin of a human subject as rinse-off treatments to clean the hair or body while improving hair fibre surface properties such as smoothness, softness, manageability, cuticle integrity, and shine. Typically such compositions are known in the art as shampoos, cleansing mousses or shower gels.

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In particular, compositions according to the invention are used for improving the deposition of silicone conditioning oil onto the tip region of hair relative to the root region of hair.

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Thus one aspect of the invention comprises a method of cleaning and conditioning hair by applying compositions according to the invention followed by rinsing.

25 The invention is further demonstrated with reference to the following, non-limiting examples:



- 25 -

Examples

Example 1 is according to the invention. Examples A B and C are comparative examples.

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Table 1

Ingredient	Trade Name	Supplier	Example A weight %	Examples B,C and 1 weight %
Sodium laureth (2 EO) sulphate	Empicol ESB70	Albright & Wilson	16	16
Coco amidopropyl betaine	Tegobetaine CK	Goldschmidt	2	2
PDMS fluid (60,000 $\text{mm}^2 \text{sec}^{-1}$ at 25°C)	DC200	Dow Corning	1	1
block copolymer	Various (see table 2)		-	0.05
Sodium Chloride	Salt	BDH	1	1
Water	-	-	To 100	To 100

Compositions in table 1 were prepared as described above by forming an aqueous emulsion of the DC200 using a suitable nonionic emulsifier and the block copolymer (when present as indicated in the table). The subsequent emulsion was then

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blended with the other ingredients except salt. The salt was finally added to thicken the composition.

#### Test Method

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0.25g/5 cm switches of tip hair which had been cleaned with a solution of 14% SLES 2EO and 2% cocoamidopropyl betaine in water followed by extensive rinsing, were used for this experiment. The test shampoo was diluted to 1 in 10 by weight with distilled water and stirred throughout with a magnetic stirrer. 5 switches were placed in one half of a petri dish. 1.5 mls of diluted shampoo was placed along the length of the switches which were then agitated in the dish for 30 seconds, followed by a rinse for 30 seconds under tap water (12° French hard) at 40°C, with a flow rate set at 3-4 litres per minute. The washing process using the test shampoo solution was repeated followed again by rinsing. The switches were then allowed to dry naturally at 25° C and a relative humidity of 45 to 60%.

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The same sequence of experimentation was carried out for 0.25g/5 cm samples of root hair.

The amount of silicone deposited on the hair samples was measured using X-ray fluorescence spectrometry (measured in parts per million (ppm) of silicon).

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Analysis results

The absolute selectivity expressed as a percentage is the ratio of silicon ppm on the tip samples to silicon ppm on the root samples multiplied by 100.

The absolute selectivity calculated for Example A (without block copolymer) was then subtracted from the absolute selectivity calculated for each of the other Example formulations to derive a targeting score. The results are shown below in Table 2. A targeting score of 5% or less is considered to be of no significant value.

Table 2

Example	Polymeric emulsifier	m	n	Molecular Weight	Targeting score(%)
A	None (DC200 benchmark)	-	-	-	0
B	ABA silicone polyether (12EO)	12	13	2000	4
C	Rake silicone polyether	-	-	-	2
1	ABA silicone polyether (40EO)	40	13	4500	16

The silicone polyethers are experimental materials supplied by Dow Corning.

Example C is a rake copolymer with EO side chains attached to a polydimethylsiloxane backbone. The results show that

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this molecular architecture does not provide targeting in this formulation.

5 Examples B and 1 are ABA block copolymers according to formula I. Both have  $n=13$ . Example B has  $m=12$  while example 1 has  $m=40$ . The results show significant targeting of silicone to the hair tip for example 1 and not for comparative example B.